Resource Conservation Training

Filtration and Separation for Wastewater recovery

MA OTA

2008

Reasons to recover water

- It's the right thing to do
- Conservation through usage reduction and reuse is insufficient
- Supply Limited - Town runs out every August
- Discharge limited – POTW Permit volume limits reached.

Water Costs Money!

- **Particularly Rinse Water**

  High Volume of water with a low level of contamination

  Rinsewater control systems are a primary opportunity area for water conservation

Combined Water and Sewer Rates

Canton

- **Supply $6.20, Sewer $7.82 per HCF (hundred cubic feet or 750 gallons)**
- **At 1000 gallon/day average, 250 days/year-**

  - Total cost $4697/yr
- **Costs vary by town, from expensive to really expensive.**

Sample combined Water and sewer rates

From 2007 MWRA Advisory board Rate Survey
1000 gallons Per Day for 250 days/year

MWRA Towns

- **Everett $2800**
- **Reading $6458**

Non MWRA

- **Springfield $2110**
- **Gloucester $7027**

Scaled Costs in Most Systems

- Canton facility above increased to 1300 gpd – unit cost above 1200 gpd is 57% higher.
- 1200 gpd costs $5636
- 100 gpd costs $735

$6373

30% increased use

36% increased cost

Types of contaminants

- Solid Particles – Dirt, Grit, Dust
- Oils and Grease
- Soaps and Detergents
- Dissolved Materials

  Acids and Bases

  Process Chemicals

  Salts and Minerals

  Metals

Wastewater Recovery Options

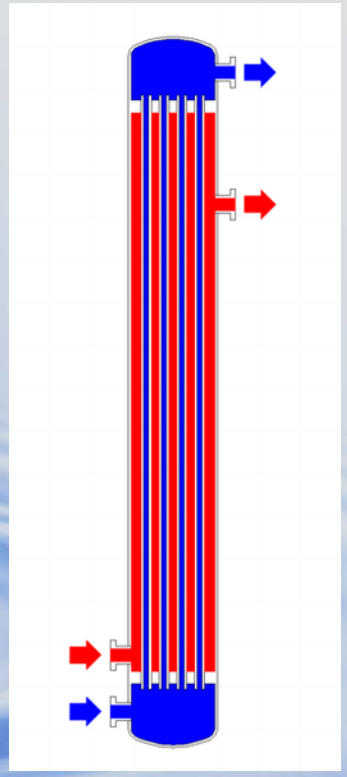
- Reuse untreated streams if possible, eg. for process cooling/heating or rinsing activity.
- Based on electricity costs, changing the temperature of one gallon of water one degree F saves $.00034

- (.0024 kwh x $0.14)

Wastewater Recovery Options

- Consider 1000 gallons per day of waste water run through a heat exchanger and raised 10 deg F

- Possible energy cost saving of $3.40/day or $850/year



Wastewater Recovery Options

- Avoid Making Soup
- Collecting and treating individual waste streams separately can be more cost effective than "End of Pipe" treatment of a tank of mixed contaminants.

Wastewater Recovery Options

- Coarse filtration for non critical reuse
  - Screens and Strainers
  - Cartridge Filters
  - Bag Filters
  - Sand Beds

Wastewater Recovery Options

- Chemical Treatment
  - Neutralization
  - Flocculation
  - Electrocoagulation

Wastewater Recovery Options

- Membrane Filtration Systems for "clean" water

Microfiltration 1 micron = 10^{-3} millimeters

Ultrafiltration 0.01 – 0.1 microns = 10^{-5}-10^{-4} mm

Nanofiltration 0.001 – 0.01 microns=10^{-6}-10^{-5} mm

Reverse Osmosis Angstrom units

Achieves 1 M-Ohm

Wastewater Recovery Options

- **Separation systems**
  - **Distillation – Heat and Vacuum**
  - **Electro-Deionization (EDI) Systems**
  - **Media Bed Deionization**
    - **Achieves 18 M-Ohm**

System costs

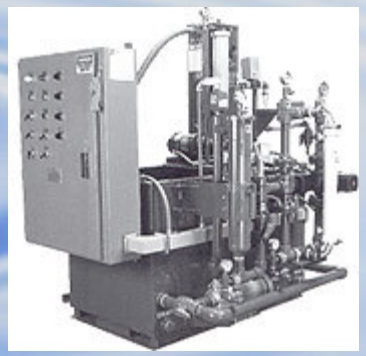
- 10 GPM Bag Filter Housing
- $200-$1000 Cost for housing
- $50-$200 Replacement Bags

System costs

- 10 GPM UF System
- Actually Rated as a 15,000 GPD System

  Capital Cost around $3500*

Can remove submicron particles, colloids, and macromolecules.



According to an AWWARF survey in 2002, the capital cost for low-pressure membrane system currently is in the range of $0.18-$0.23/gallon per day (gpd)
(Lozier and Jacangelo, 2002)

System costs

- 1000 GDP RO System For Potable Water
  Capital cost $5000-$9000*
- Reject Stream requires management
- 1 Mega-ohm possible
- Removes Solutes, Ions

*U.S. Army Corps of Engineers Cost Estimates
for RO Desalination Plants in Florida

System costs

- **1000 GPD DI System**
- **Capital Cost $2500-$3200**
- **Removes ions**
- **Can achieve 18 Mega-Ohm**

*Remco

Operating Costs

-RO System (Mass. Electric rates)

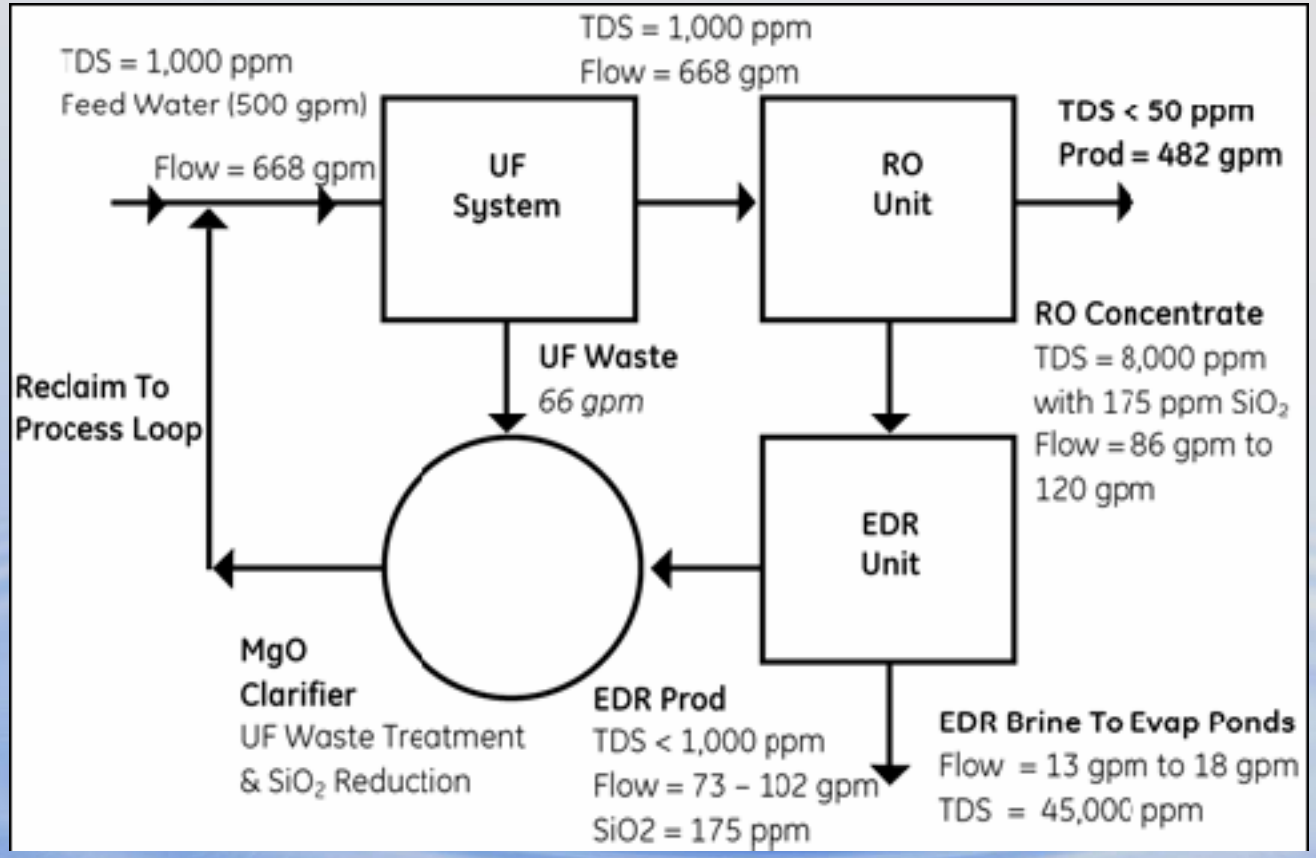
$0.01-0.02/Gallon $10-20/day

Town Water Cost $18/day

-DI System

$0.03-.04/Gallon $40/day

Composite Systems
Figure 3: EDR Reclaims RO Concentrate For 97% Water Recovery



Resources

- OTA Materials

- Introduction to Membrane Technology in Wastewater Recycling

  http://www.p2pays.org/ref/09/08866.htm

OTA is Here to **HELP YOU**!

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